REMARKS

Claims 1, 3, and 5-9, 11, 13-17, 19, 21-25, 27, 19-32 are pending in the application. Claims 1, 9, 13, 14, 17, 21, 22, 25, 29, and 30 are amended. Claims 2, 4, 10, 12, 18, 20, 26, and 28 are cancelled. Claim 1 is amended to incorporate the subject matter of claims 2 and 4. Claim 9 is amended to incorporate the subject matter of claims 10 and 12. Claim 17 is amended to incorporate the subject matter of claims 18 and 20. Claim 25 is amended to incorporate the subject matter of claims 26 and 28. Claims 13, 14, 21, 22, 29, and 30 are amended to depend from non-cancelled claims.

The Office Action rejected claims 1-32 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,704,812 to Bakke et al. ("Bakke").

Anticipation under § 102(e) requires that a single reference teach each of the claimed elements arranged as in the claim. Claim 1 recites, *inter alia*, "wherein said computer program includes an algorithm for assigning a path weight to a channel path candidate dependent upon the type of channel containing the channel path candidate." Bakke fails to teach at least this element. In fact, Bakke teaches the opposite, i.e. determining a path independent of the type of channel:

> [T]he redundancy manager manages commands on the plurality of independent physical paths independent of command processing and independent of the protocols of the independent physical paths. The redundancy manager may further comprise a path determiner which dynamically chooses for each command the independent path for the command to the peripheral device. (Bakke, col. 4, lines 45-52).

Bakke generally discloses a load balancing method where the load balancing factors are on a per command basis and could be different for different protocols. (Bakke, abstract). Bakke discloses a common formula used for every path. (Bakke, col. 11, lines 39-44). By contrast, the claimed algorithm assigns a path weight on a per path basis for the same I/O request where each path may have an entirely different set of criteria or formula to determine the path weight that is comparable against other path weights for other different kinds of paths connected to the same target device.

Claims 9, 17, and 25 are patentable over Bakke for the same reasons as claim 1. Claims 3, and 5-8, which depend directly or indirectly from claim 1, inherit at least the

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patentable subject matter of claim 1 and, thus, are also patentable over Bakke. Claims 11 and 13-16, which depend directly or indirectly from claim 9, inherit at least the patentable subject matter of claim 9 and, thus, are also patentable over Bakke. Claims 19 and 21-24, which depend directly or indirectly from claim 17, inherit at least the patentable subject matter of claim 17 and, thus, are also patentable over Bakke. Claims 27, and 29-32, which depend directly or indirectly from claim 25 inherit at least the patentable subject matter of claim 25 and, thus, are also patentable over Bakke.

In addition, Bakke fails to disclose at least these elements of claim 6: "channel busy data (CBD) stored by each channel for containing the status of channel paths in the respective channel, and an IOP copy of said CBDs stored by said IOP, and said computer program includes an algorithm for using data in said CBDs for assigning a path weight to a channel path candidate." The "redundancy manager" in Bakke "dynamically balances" the loads "on a per command basis". (Bakke, col. 12, line 23 to col. 24, line 25). Bakke does not indicate that any channel busy data is stored by each channel as in claim 6. Nor does Bakke indicate that any channel busy data is stored by the redundancy manager as it is stored by the IOP in claim 6. The fact that load balancing is performed dynamically and on a per command basis seems to indicate that no such storage is occurring.

Additionally, Bakke fails to disclose at least these elements of claim 8: "multiple IOPs, each channel path having an affinity to one IOP, a work queue having work elements for each IOP, and said computer program comprises a loop for determining the best class of available candidates, and from that class picking the candidate that has affinity to the IOP with the least number of work elements on its work queue." Bakke does not consider paths connected to multiple "redundancy manager" in multiple adapters for a given command; instead, Bakke only considers paths 222, 232 directly connected to a particular "redundancy manager" 350 in a single adapter 140 for a given command. (Bakke, figures 1-3; col. 12, line 23 to col. 24, line 25; col. 7, lines 36-40). Thus, the selection pool in Bakke is more limited.

One advantage of having channel busy data stored by each channel and a copy of the channel busy data stored by the IOP is that this data can be shared among multiple IOPs. This allows any IOP to have access to channel busy data for channels connected to different IOPs. As a result, an I/O operation to a device via one path can reconnect on another path to report completion status, for example. It would become complex for an IOP, on its own, to

accurately determine if an operation for a particular path had completed if the device reconnected to another path, especially if the path was on another IOP. Thus, an IOP that does not have affinity to channels can acquire the channel busy data for those paths on another IOP, even though the IOP exercising path selection cannot directly issue the I/O request to those channels on another IOP. In the claimed invention, paths that have affinity to another IOP are considered if, for example, the data for paths on the current IOP are all bad. In this way, overhead is avoided by not having to send the I/O requests over to another IOP. To figure out which IOP to send the I/O request to, channel busy data for paths on other IOPs are considered, then the best path is selected to assure the path on the best IOP services the I/O request the fastest. Therefore, the claimed invention has at least this advantage over Bakke.

The Office Action rejected claims 1-32 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,574,667 to Blumenau et al. ("Blumenau").

Anticipation under § 102(e) requires that a single reference teach each of the claimed elements arranged as in the claim. Claim 1 recites, *inter alia*, "a computer program executed by said IOP for assigning a path weight to selected ones of said channel paths whereby the next channel path to carry data between said main memory and said I/O devices is selected". Blumenau fails to disclose at least this element. The Office Action equated the claimed "computer program" with a "switch control computer" that "selects a storage port from the list in a round-robin fashion" or "in a random or pseudo-random fashion". (Office Action, page 4; Blumenau, col. 6, lines 35-38). However, selection of a storage port in Blumenau is not performed in the same manner as the claimed selection of the next channel path, because Blumenau does not assign any path weights.

In addition, claim 1 recites, *inter alia*, "wherein said computer program includes an algorithm for assigning a path weight to a channel path candidate dependent upon the type of channel containing the channel path candidate." Blumenau also fails to disclose at least this element. For this element, the Office Action cited "If one host has much more demanding bandwidth requirements than the other hosts, it may be desirable to connect the one host directly, via a private link." (Office Action, page 5; Blumenau, col. 16, lines 60-63). In addition to not assigning a path weight, Blumenau also does not assign the path weight

dependent on the type of channel. The claimed invention is not concerned with creating private links.

Claims 9, 17, and 25 are patentable over Blumenau for the same reasons as claim 1. Claims 3, and 5-8, which depend directly or indirectly from claim 1, inherit at least the patentable subject matter of claim 1 and, thus, are also patentable over Blumenau. Claims 11 and 13-16, which depend directly or indirectly from claim 9, inherit at least the patentable subject matter of claim 9 and, thus, are also patentable over Blumenau. Claims 19 and 21-24, which depend directly or indirectly from claim 17, inherit at least the patentable subject matter of claim 17 and, thus, are also patentable over Blumenau. Claims 27, and 29-32, which depend directly or indirectly from claim 25 inherit at least the patentable subject matter of claim 25 and, thus, are also patentable over Blumenau.

Furthermore, Blumenau does not anticipate claim 6. Claim 6 recites, *inter alia*, "channel busy data (CBD) stored by each channel for containing the status of channel paths in the respective channel, and an IOP copy of said CBDs stored by said IOP, and said computer program includes an algorithm for using data in said CBDs for assigning a path weight to a channel path candidate." The Office Action cited "Because the same storage in the storage subsystem can be accessed from any of the storage ports, a host that sends a storage access request to a storage port and receives a busy response from the switch 40 can re-send the storage access request and the request can be routed by the switch to any other storage port." (Office Action, page 5; Blumenau, col. 5, lines 52-57). What is stored in the storage subsystem is the I/O in the storage access request, not the "busy response", because the host has to re-send the storage access request. Also, Blumenau does not disclose any way for the port adapters to directly supply the activity accumulator data, so the port switch routing function must maintain this count. (Blumenau, figure 9, col. 13 line 31 to col. 14 line 16). Thus, Blumenau does not disclose any such claimed storage of channel busy data at a channel nor at an IOP.

Additionally, Blumenau does not anticipate claim 8. Claim 8 recites, *inter alia*, "multiple IOPs, each channel path having an affinity to one IOP, a work queue having work elements for each IOP, and said computer program comprises a loop for determining the best class of available candidates, and from that class picking the candidate that has affinity to the IOP with the least number of work elements on its work queue." Blumenau discloses using a

routing table 46 to determine the storage port, so that not all hosts 22-25 or loops 43-44 have access to all of the storage ports of the port adapters 35-36, where the switch computer 45,47 periodically updates the routing tables based on loading. (Blumenau, figure 2, col. 6, lines 25-53). The claimed invention allows any channel having connectivity to I/O devices to be eligible for path selection regardless of which IOP ("host") is requesting an I/O operation. Thus, if there is a concentration of many I/O requests from one IOP ("host"), the requests can be interspersed to the I/O devices among all of the paths rather than, as Blumenau discloses, restricting the path selection to a subset of them until the routing table gets refreshed with a set of new paths.

For all the reasons advanced above, it is respectfully submitted that the application is in condition for allowance. Accordingly, reconsideration and allowance of the claims are respectfully requested. The Examiner is cordially requested to telephone, if the Examiner believes that it would be advantageous to the disposition of this case.

The Commissioner is hereby authorized to charge any additional fees or credit any overpayment, which may be required for this amendment, to Deposit Account No. 09-0463. In the event that an extension of time is required, or may be required in addition to that requested in any petition for an extension of time, the Commissioner is requested to grant a petition for that extension of time which is required to make this response timely and is hereby authorized to charge any fee for such an extension of time or credit any overpayment for an extension of time to Deposit Account No. 09-0463.

Respectfully submitted,

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